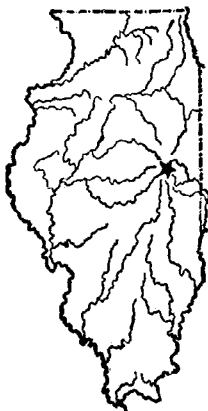# UNIVERSITY OF ILLINOIS

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A STUDY OF THE RELATIVE RELIABILITY OF OFFICIAL TESTS OF DAIRY COWS

By W. W. YAPP

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Contents of Bulletin No. 215

A STUDY OF THE RELATIVE RELIABILITY OF OFFICIAL TESTS OF DAIRY COWS

By W. W. YAPP, Associate in Dairy Husbandry

INTRODUCTION

The rearing of pure-bred cattle for dairy and breeding purposes has developed into a business of considerable financial importance, no small part of which has been brought about by the establishment of systems of Advanced Registry based upon milk and butter-fat production.

During the earlier years of the life of the various breed associations but few records were made, and the supervision of official testing was essentially a simple process. During this period it was extremely desirable to have a test which was easily operated and, at the same time, relatively inexpensive. The short-time test seemed to meet these requirements satisfactorily and therefore was placed in service in some of the breed associations.

Thru the general use of these short-time tests the cows, in at least one of these associations, made a very noticeable increase in butter-fat production. So great was this apparent increase that some breeders were led to believe that a longer test period might represent more accurately the real value of these cows as producers of milk and butter fat. This feeling spread over the country to a considerable extent, and it was with the idea of throwing some light upon the reliability of these short-time tests that the studies which are reported herein were begun.

These studies are confined entirely to the Holstein-Friesian breed of dairy cattle, owing partly to the fact that more tests of this breed were available for comparison and partly to the fact that the Holstein-Friesian Association made the seven-day test the basis of requirement for entry to the Advanced Register.

EXPLANATION OF TESTS

Thruout the course of this work references will be made repeatedly to the different test periods, the most important of which are: the seven-day test, the thirty-day test, the seven-day test eight months after calving, and the semiofficial long-time test, which usually covers a yearly period.

The seven-day test is an official test[1] which covers a period of seven

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[1] An official test is one in which the supervisor or tester weighs and tests the milk of each milking separately, being present at each and every milking during the entire testing period.

consecutive days and may be begun as early as the seventh day after a cow's last calving. After satisfying the minimum requirements for this test, cows are admitted to the Advanced Registry and are designated as A. R. O. cows.[1] None of the other tests named will be accepted for publication by the Advanced Registry unless they are made by A. R. O. cows.[2]

The thirty-day test is one which covers a period of thirty consecutive days and is governed by essentially the same rules as the seven-day test.

The seven-day test eight months after calving is also an official test, and may be begun not less than eight months (240 days) after a cow's last calving. In order that this test be accepted for publication in the Advanced Register, it must be preceded by a seven-day test made during the same lactation period; and there must be an interval of not less than 170 days between the two tests.

The semiofficial long-time test[3] may be begun not earlier than the fourth day after calving, and may be continued during that period of lactation or such consecutive part of it as the owner may desire, but it must not exceed 365 days in length. If this test is made of the production of an A. R. O. cow, and the results meet the established requirements, the test is accepted for publication by the Advanced Registry.

NATURE OF AVAILABLE RECORDS

All the records used in this work have been taken from the Holstein-Friesian Advanced Register, the official publication of the Holstein-Friesian Association. In collecting these data, all cows and heifers which had made semiofficial long-time tests with comparable[4] seven-day tests prior to May 1, 1915, were included. In addition, a study was made of all the thirty-day tests and of all the seven-day tests eight months after calving which had comparable seven-day tests

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[1] The letters A. R. O. stand for Advanced Registry Official and indicate that the test was official, that is, made under continuous supervision.

[2] A recent ruling of the Association has waived the seven-day test as a requirement for entry to the Advanced Registry for the semiofficial test.

[3] A semiofficial test is one in which the percentage of fat in the milk is determined by an official test that covers a period of not less than two consecutive days each month. The approximate fat production for the month is found by multiplying the weight of milk which the owner supplies by a number representing the percentage of fat found during the period of official test. The total fat production for the period is the sum of these various monthly credits.

[4] In this study a comparable test is considered as one that is made by the same cow during the same lactation period. A cow might have a seven-day test made as a two-year old and a semiofficial test made as a mature cow, but these would not be comparable and therefore would not be given consideration in this study.

and were made prior to May 1, 1913. In selecting the individuals which possessed semiofficial tests, only those with records covering a period of 330 days or more were included. All the tests used in this work are official tests except those designated as semiofficial.

PLAN OF INVESTIGATION

In this study the semiofficial test has been taken as the standard and has been used as the basis for comparison. After checking the accuracy of the semiofficial test, an attempt has been made to determine its relationship to the seven-day test with respect to the percentage of fat which each carries. The thirty-day test and the seven-day test eight months after calving have each been compared with their comparable seven-day tests. To show the extent to which the seven-day tests may be used as an indication of yearly production, correlation coefficients have been calculated for the seven-day and the yearly tests, both for milk and for fat.

ACCURACY OF THE SEMIOFFICIAL TEST

It became evident early in this study that it was necessary to establish some basis of comparison for the different records. Naturally, the yearly record, since it covered a longer period, suggested itself as the standard by which the other records might be measured. It was realized, however, that the method employed in determining yearly production had been criticized by some for its lack of accuracy, and it was decided advisable to check the accuracy of this test, in so far as possible.

For a number of years, a daily record, to which each milking contributed proportionately, has been kept of the production of each cow in milk in the University herd. A number of these cows have also made semiofficial records. For convenience, the test regularly used in the University herd is designated as the "continuous test."[1]

In order to measure the relationship between these two methods of testing, the mean, the standard deviation, and the coefficient of variability are calculated for the fat production as obtained by each.[2] Tables 1 and 2 present the results.

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[1] In the University herd the continuous test is conducted essentially as follows: Each milking is weighed and sampled. The sample taken, which represents an aliquot part of the milk, is placed in a closed bottle containing a small amount of preservative. At the end of each week the composite thus formed is tested for butter fat. The fat percentage found is taken as the average for the week, and when multiplied by a number representing the pounds of milk for that period, gives the weekly fat production. The sum of these various weekly productions constitutes the yearly butter-fat record.

[2] It is not necessary to compare these two methods of testing with respect to the amount of milk produced, since both methods require that the milk of each and every milking be accurately weighed and recorded.

TABLE 1.—YEARLY BUTTER-FAT PRODUCTION OF THIRTY COWS IN THE UNIVERSITY
HERD, AS ASCERTAINED BY THE CONTINUOUS TEST

Class interval; fat production, *lbs.*		Frequency	Average deviation	F(AD)		F(AD)²
	250—300	1	-3	-3		9
	301—350	3	-2	-6		12
	351—400	9	-1	-9	-18	9
425.5	401—450	10	0	0		0
50	451—500	3	+1	+3		3
	501—550	3	+2	+6		12
	551—600	1	+3	+3	+12	9
		30			-6	54

Mean: 425 — 10.00 = 415.50 ± 8.12
Standard deviation: 66.1 ± 5.76
Coefficient of variability: 15.90 ± 1.38

TABLE 2.—YEARLY BUTTER-FAT PRODUCTION OF THIRTY COWS IN THE UNIVERSITY
HERD, AS ASCERTAINED BY THE SEMIOFFICIAL TEST

Class interval; fat production, *lbs.*		Frequency	Average deviation	F(AD)		F(AD)²
	251—300	1	-3	-3		9
	301—350	4	-2	-8		16
	351—400	10	-1	-10	-21	10
425.5	401—450	8	0	0		0
50	451—500	4	+1	+4		4
	501—550	2	+2	+4		8
	551—600	1	+3	+3	+11	9
		30			-10	56

Mean: 425.5 — 16.65 = 408.85 ± 8.14
Standard deviation: 66.25 ± 5.77
Coefficient of variability: 16.20 ± 1.41

From a study of these tables it is observed that the mean, or average, production of the cows when making the continuous test was 415.5 pounds of fat ± 8.1 pounds; whereas the semiofficial test of the production of the same cows during the same period shows 408.9 pounds ± 8.1. This slight difference between the averages shown by the two different methods of testing is not regarded as significant.

The standard deviation in the case of the continuous test is 66.1 ± 5.8; while that for the semiofficial is 66.25 ± 5.8. Again there is a rather unusually close relationship between the two methods of testing. The coefficient of variability in the case of the continuous test is 15.90 ± 1.38 percent; whereas, in the case of the semiofficial test. it is 16.20 ± 1.41 percent, a difference that is not significant.

These data are not held to be comprehensive, but so far as the limited number of records involved can be used to indicate the relation between the two tests, they seem to indicate very little difference.

These data support the general opinion that the semiofficial test is a fairly accurate measure of the producing ability of cows.

RELATION OF FAT PERCENTAGE TO TEST PERIOD

SEVEN-DAY TEST

In the study of the percentage of fat in the milk during these various test periods, it is necessary to deal in averages. Table 3 shows the variation in fat percentage between low and high fat production for the seven-day test. The data are presented graphically in Fig. 1.

TABLE 3.—SEVEN-DAY TEST: RELATION BETWEEN AMOUNT OF FAT AND PERCENTAGE OF FAT

Class interval; fat production	Frequency	Milk production	Fat test	Fat production
lbs.		*lbs.*	*percent*	*lbs.*
Under 9.00	28	268.4	3.14	8.415
9.01—12.00	192	318.5	3.36	10.697
12.01—15.00	350	381.0	3.53	13.441
15.01—18.00	374	453.1	3.64	16.479
18.01—21.00	214	503.3	3.84	19.325
21.01—24.00	114	574.6	3.97	22.837
24.01—27.00	18	587.1	4.26	25.025
27.01 and over	4	567.5	5.15	29.226

From this study of the seven-day test it is shown that low fat production is accompanied by a correspondingly low fat percentage, and high fat production accompanied by a relatively high fat percentage. Individuals that produced on the average 8.415 pounds of fat for the seven-day period produced milk having an average fat
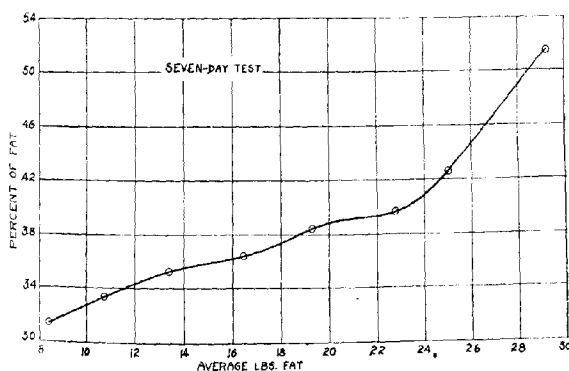

FIG. 1.—SEVEN-DAY TEST: RELATION BETWEEN AMOUNT OF FAT AND PERCENTAGE OF FAT

test of 3.14 percent; whereas those producing an average of 25.025 and 29.226 pounds of fat for the same period produced milk having an average fat test of 4.26 and 5.15 percent, respectively; the difference between the lowest and the highest group in percentage of fat being 2.01 percent. Not only is the increase in the amount of fat produced, accompanied by a corresponding increase in the percentage of fat, but there is also an increase in milk production, tho not in proportion to the fat increase.

One of the noticeable features of the curve shown in Fig. 1 is its smoothness, there being a tendency for it to rise uniformly with the increase in fat production. This fact indicates that high butter-fat records for the seven-day period are secured, to a rather high degree, by high fat tests rather than by unusually heavy milk production.

SEMIOFFICIAL TEST

Table 4 and Fig. 2 show the relation between amount of fat and percentage of fat as recorded under the semiofficial test.

TABLE 4.—SEMIOFFICIAL TEST: RELATION BETWEEN AMOUNT OF FAT AND PERCENTAGE OF FAT

Class interval; fat production	Frequency	Milk production	Fat test	Fat production
lbs.		lbs.	percent	lbs.
251—350	83	9 583.7	3.35	320.585
351—450	349	12 100.6	3.35	405.382
451—550	410	14 747.0	3.39	499.977
551—650	270	17 142.1	3.47	595.983
651—750	122	19 875.9	3.48	691.735
751—850	35	21 720.8	3.62	787.161
851—950	16	24 453.3	3.65	892.332
951—1050	9	26 225.6	3.79	993.367
1051—1150	1	24 612.8	4.53	1 116.050

A study of this table shows that under the semiofficial test there is a difference between the fat percentage of low butter-fat production and that of high butter-fat production, but this difference is not nearly so great as in the case of the seven-day test. In the semiofficial test, low butter-fat production is not accompanied by an extremely low fat percentage nor is high butter-fat production accompanied by an extremely high fat percentage. In low production (320.585 pounds of fat for the yearly period) the average percentage of fat was 3.35; whereas in high production (993.367[1] pounds of fat for the same period) the average percentage of fat was 3.79, a variation in fat test between low and high production of only 0.44 percent.

[1]The last group, in which the variation is between 1,051 and 1,150 pounds of fat, is not considered.
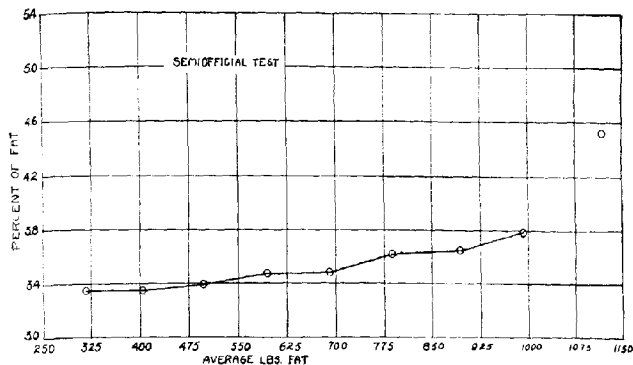
FIG. 2.—SEMIOFFICIAL TEST: RELATION BETWEEN AMOUNT OF FAT AND
PERCENTAGE OF FAT

The curve in Fig. 2 shows a tendency to rise, but the rise is much
less marked than in the case of the curve in Fig. 1. The tendency
in the semiofficial test seems to be to secure high fat production by
means of an increased milk production rather than thru a very high
fat percentage. The difference in the results from these two tests is
brought out more clearly when the two curves are superimposed upon
the same graph. This is possible since both curves are drawn to the
same scale. Fig. 3 shows this relationship.

FIG. 3.—COMPARISON OF SEVEN-DAY AND SEMIOFFICIAL TESTS WITH RESPECT TO
THE RELATION BETWEEN AMOUNT OF FAT AND PERCENTAGE OF FAT

These curves correspond very closely in fat percentage in the case of low butter-fat production. As the production increases, howeve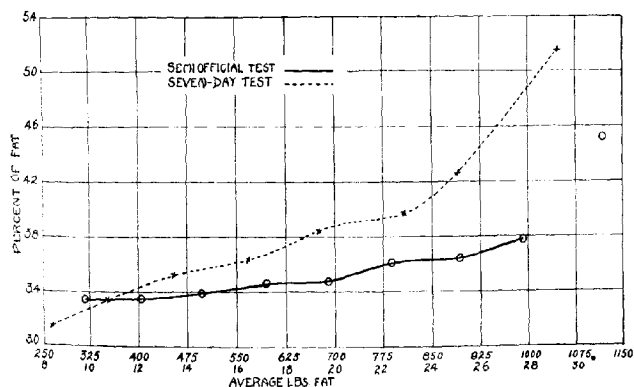r, there is a tendency for the curves to separate, with the seven-day test showing the higher percentage of fat. The difference between the two is greatest in the case of high butter-fat production, the maximum difference being as great as .47 percent.

VARIABILITY IN PERCENTAGE OF FAT

Not only is the percentage of fat for the seven-day test higher than that for the semiofficial period, but it is also much more variable. Fig. 4 shows this variability.

The seven-day test, it will be noted, carries not only a high average fat percentage, but in a number of single cases the fat tests are exceptionally high. The spread of the curve which represents the fat percentage for the seven-day test indicates considerably more variability than is shown by the semiofficial test. The curve representing the percentage of fat for the semiofficial test indicates that there is variability but that the variability is less than in the preceding case. This curve is nearly symmetrical in form and approximates what is called the normal probability curve.

Altho these curves show that there is a certain variability in fat percentage, they do not measure this variability. To determine the variability within each of these tests, standard deviations and coefficients of variability have been calculated.

SEVEN-DAY TEST

Table 5 shows the variability in fat percentage for the seven-day test. It is observed that the mean, or average, fat percentage for the 1,295 records considered is 3.679 ± 0.01. This percentage is not regarded as high for a single individual or a small group of selected individuals of the Holstein-Friesian breed, but it is considered high for a large and fairly representative group. The small probable error of ± 0.01 indicates that the records of the 1,295 cows considered were adequate to determine relatively accurately the average percentage of fat produced by the class of cows that have completed seven-day records. Altho the mean gives a satisfactory measure of the average fat percentage for all cows of the class that have completed seven-day tests, it does not give any idea as to whether or not some of the cows produced milk exceptionally high or exceptionally low in percentage of fat.

The standard deviation, on the other hand, describes this variability. For the seven-day test we find a standard deviation of .5256 ± .007. This is regarded as a fairly high degree of variability. The coefficient of variability, 14.29 ± .18 percent, gives the same general result.
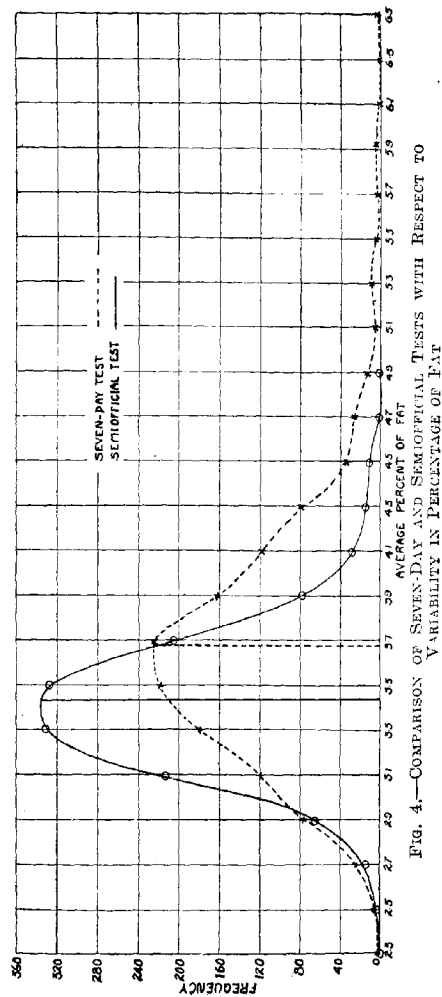
FIG. 4.—COMPARISON OF SEVEN-DAY AND SEMIOFFICIAL TESTS WITH RESPECT TO VARIABILITY IN PERCENTAGE OF FAT

TABLE 5.—SEVEN-DAY TEST: VARIABILITY IN FAT PERCENTAGE

Class interval; fat test, *percent*		Frequency	Average deviation	F(AD)		F(AD)²
	2.21—2.40	0	0	0		0
	2.41—2.60	4	-6	-24		144
	2.61—2.80	22	-5	-110		550
	2.80—3.00	76	-4	-304		1 216
	3.01—3.20	119	-3	-357		1 071
	3.21—3.40	178	-2	-356		712
	3.41—3.60	217	-1	-217	-1 368	217
3.705	3.61—3.80	223	0	0		0
.2	3.81—4.00	161	1	161		161
	4.01—4.20	118	2	236		472
	4.21—4.40	80	3	240		720
	4.41—4.60	33	4	132		528
	4.61—4.80	26	5	130		650
	4.81—5.00	13	6	78		468
	5.01—5.20	5	7	35		245
	5.21—5.40	8	8	64		512
	5.41—5.60	4	9	36		324
	5.61—5.80	3	10	30		300
	5.81—6.00	4	11	44		484
	6.01—6.20	0	12	0		0
	6.21—6.40	0	13	0		0
	6.41—6.60	1	14	14	+1 200	196
		1 295			− 168	8 970

Mean: 3.679 ± .010
Standard deviation: 0.5256 ± .0069
Coefficient of variability: 14.29 ± .18

SEMIOFFICIAL TEST

The calculation of the mean, the standard deviation, and the coefficient of variability for the semiofficial test furnishes an added opportunity for comparison. Table 6 shows the variability in percentage of fat for the semiofficial test.

The mean, or average percentage of fat, for the semiofficial period is 3.43 ± .006 percent. It is true that this average test is based on a rather selected group of cows; but the probable error (± .006) indicates that this group of 1,295 is adequate to determine a reliable average percentage of fat for the class of cows making semiofficial tests. The standard deviation of .317 ± .004 indicates that there is variability, but this variability is not so great as that found in the case of the seven-day test, the coefficient of variability being 9.22 ± .12.

In fat percentage the seven-day test is more variable than the semiofficial, the difference between the two tests being quite significant. This fact is of importance to the breeder who is forced to make selections from cows with seven-day records when he desires to breed up a herd in which the individuals have a higher percentage of fat in their milk for longer periods.

TABLE 6.—SEMIOFFICIAL TEST: VARIABILITY IN FAT PERCENTAGE

Class interval; fat test, *percent*		Frequency	Average deviation	F(AD)		F(AD)²
	2.21—2.40	1	-5	-5		25
	2.41—2.60	2	-4	-8		32
	2.61—2.80	14	-3	-42		126
	2.81—3.00	65	-2	-130		260
	3.01—3.20	213	-1	-213	-398	213
3.305	3.21—3.40	333	0	0		0
.2	3.41—3.60	329	1	329		329
	3.61—3.80	205	2	410		820
	3.81—4.00	78	3	234		702
	4.01—4.20	29	4	116		464
	4.21—4.40	15	5	75		375
	4.41—4.60	10	6	60		360
	4.61—4.80	0	7	0		0
	4.81—5.00	1	8	8	+1 232	64
		1 295			+ 834	3 770

Mean: 3.434 ± .006
Standard deviation: .3166 ± .004
Coefficient of variability: 9.22 ± .12

COMPARISON OF SEVEN- AND THIRTY-DAY TESTS

Many breeders are continuing their cows on official test for a thirty-day period. Naturally they are interested in knowing how it compares with the seven-day test. Table 7 and Fig. 5 show the relation between the seven-day and the thirty-day tests with respect to fat percentage.

TABLE 7.—COMPARISON OF SEVEN- AND THIRTY-DAY TESTS

Seven-day test			Fre-quency	Thirty-day test		
Milk production	Fat test	Fat pro-duction		Milk production	Fat test	Fat pro-duction
lbs.	*percent*	*lbs.*		*lbs.*	*percent*	*lbs.*
246.8	3.41	8.415	4	1 021.8	3.32	33.907
330.2	3.29	10.853	74	1 367.3	3.19	44.362
394.5	3.45	13.623	216	1 640.9	3.33	54.691
465.7	3.59	16.702	372	1 937.5	3.45	66.762
528.3	3.66	19.692	349	2 238.0	3.52	78.578
580.6	4.05	23.534	375	2 445.0	3.80	92.997

In this comparison between seven- and thirty-day tests, the records are arranged in groups according to seven-day production. With this arrangement there may be a tendency for the thirty-day test to regress toward the mean fat percentage for cows in general, but when it is considered that in almost every case the seven-day test forms a part of the thirty-day period, it is apparent that the tendency to regress must be slight.

The curves in Fig. 5 show that there is a uniform difference between these two tests with respect to the percentage of fat found in the milk. This comparison, based on an aggregate of 1,390 individual records, shows the seven-day test to have the higher percentage of fat. The difference in fat percentage between the tests is greatest in the case of high production. In low production the variation is .1 percent of fat; in high production, .25 of fat; making a difference of .15 percent between the extremes.
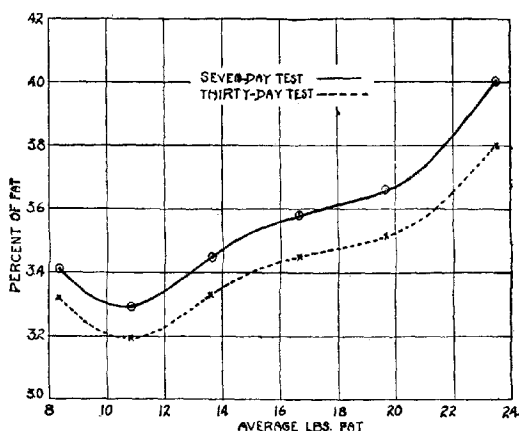

FIG. 5.—COMPARISON OF SEVEN-DAY AND THIRTY-DAY TESTS WITH RESPECT TO PERCENTAGE OF FAT

The drop in the curve in low production may be due to the fact that only four individual records are included in the averages which constitute the first group. Generally speaking, this number of records would be insufficient to establish dependable results.

COMPARISON OF THE SEVEN-DAY TEST AND THE SEVEN-DAY TEST EIGHT MONTHS AFTER CALVING

The seven-day test eight months after calving has evidently been little favored by breeders of Holstein-Friesian cattle, as only 209 tests were available for comparison prior to May 1, 1913. Table 8 shows the average fat percentage of the various groups for the original seven-day test when arranged according to amount of fat production, and Table 9 shows the same for the seven-day test eight months after calving. For graphic presentation, see Figs. 6 and 7.

TABLE 8.—ORIGINAL SEVEN-DAY TEST: RELATION BETWEEN FAT PRODUCTION
AND FAT TEST

Class interval; fat production	Frequency	Milk production	Fat test	Fat production
lbs.		*lbs.*	*percent*	*lbs.*
Under 9.00	4	261.1	3.15	8.236
9.01—12.00	32	316.7	3.38	10.698
12.01—15.00	55	383.7	3.48	13.366
15.01—18.00	58	450.0	3.67	16.531
18.01—21.00	39	515.8	3.76	19.379
21.01 and over	21	593.8	4.08	24.246

TABLE 9.—SEVEN-DAY TEST EIGHT MONTHS AFTER CALVING: RELATION
BETWEEN FAT PRODUCTION AND FAT TEST

Class interval; fat production	Frequency	Milk production	Fat test	Fat production
lbs.		*lbs.*	*percent*	*lbs.*
Under 8.00	30	211.1	3.28	6.925
8.01—10.00	69	262.5	3.46	9.085
10.01—12.00	59	305.9	3.62	11.084
12.01—14.00	33	359.5	3.62	12.987
14.01—16.00	11	401.0	3.68	14.749
16.01—18.00	6	423.5	3.78	15.993
18.01 and over	1	492.1	4.31	21.195

From a study of these tables and curves it is evident that there
is a slight difference between the two tests in low fat production; the
seven-day test eight months after calving being slightly higher in fat
percentage than the original seven-day test. In the case of those cows
which averaged 10.698 pounds of fat for the original seven-day test,
the average fat percentage was 3.38; whereas cows that averaged
9.085 pounds fat when tested for seven days eight months after
calving, had an average fat percentage of 3.46.

In high average fat production the reverse is true, the original
seven-day test having the higher fat percentage. Those cows which
averaged 24.246 pounds of fat for the original seven-day test pro-
duced, on the average, milk testing 4.08 percent. On the other hand,
cows producing an average of 15.993 pounds of fat in the seven-day
test eight months after calving, produced milk which on the average
tested but 3.78 percent; there being a greater difference between the
two tests in the percentages representing high average fat production
than in the percentages representing low average fat production.

In this comparison, it must be borne in mind that a relatively small
number of records are involved, and therefore that too much signifi-
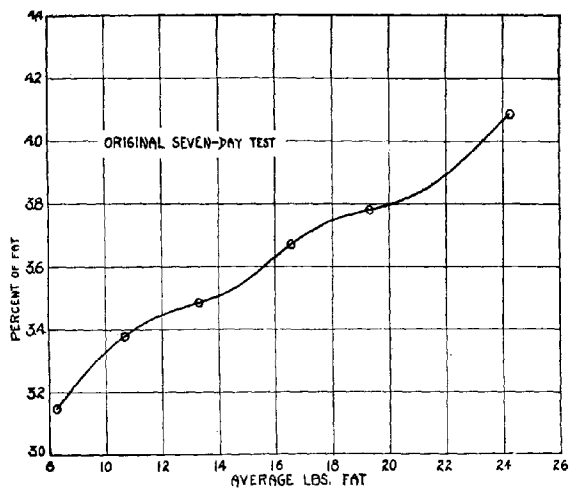cance should not be attached to the results.

FIG. 6.—ORIGINAL SEVEN-DAY TEST: RELATION BETWEEN AMOUNT OF FAT AND
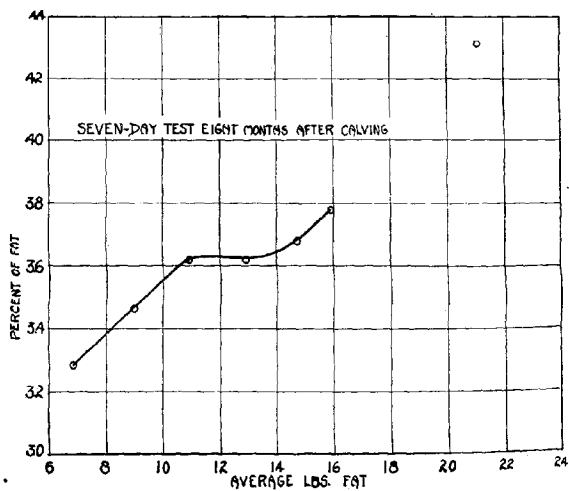PERCENTAGE OF FAT

FIG. 7.—SEVEN-DAY TEST EIGHT MONTHS AFTER CALVING: RELATION BETWEEN
AMOUNT OF FAT AND PERCENTAGE OF FAT

CORRELATION BETWEEN SEVEN-DAY AND SEMI-OFFICIAL MILK TESTS

The measurement of correlation in this study has been confined to seven-day and semiofficial tests. The popularity and extensive use of the seven-day test makes it extremely desirable that the extent to which it may be used as an indication of semiofficial production, be determined. To measure the relationship which exists between these two tests, correlation tables have been used and coefficients have been determined.

TABLE 10.—CORRELATION BETWEEN SEVEN-DAY AND SEMIOFFICIAL MILK PRODUCTION

Semiofficial Milk Production

Class interval; milk production, lbs.	7001—9000	9001—11000	11001—13000	13001—15000	15001—17000	17001—19000	19001—21000	21001—23000	23001—25000	25001—27000	27001—29000	29001—31000	Total
201—250	7	6	4	..	..	..	..	..	..	..	..	..	17
251—300	11	33	34	13	1	..	..	..	..	..	..	..	92
301—350	6	35	73	43	14	2	1	..	..	..	..	..	171
351—400	3	20	70	70	47	14	2	1	..	..	..	..	227
401—450	1	8	45	80	82	39	14	3	1	1	..	..	274
451—500	..	4	31	51	46	47	17	6	1	..	..	..	203
501—550	..	1	8	22	33	48	27	16	3	..	1	..	158
551—600	..	..	3	5	23	25	17	11	1	..	1	1	87
601—650	..	..	..	2	4	7	8	10	6	4	1	..	42
651—700	..	..	..	..	1	2	1	2	2	..	2	1	11
701—750	..	..	..	..	..	..	1	..	..	2	1	1	5
751—800	..	..	..	..	..	..	..	1	2	..	1	..	4
801—850	..	..	..	..	..	..	..	..	..	..	..	..	0
851—900	..	..	..	..	..	..	..	..	..	..	..	..	0
901—950	..	..	..	..	..	..	..	..	..	..	1	..	1
Total	28	107	268	286	251	184	88	50	16	7	7	3	1 295

(Seven-Day Milk Production)

Table 10 shows the distributions from which the coefficient of correlation for the seven-day and the semiofficial milk production records has been calculated. A study of the results shows that there is a coefficient of correlation of .702 ± .01 between the seven-day and the semiofficial tests. The correlation .702 is for certain purposes a high degree of correlation, but it is not a high degree of correlation between two measurements of the same thing. That is to say, we are here concerned with two methods of measuring milk production of the same cow, and in order that each of them may be an effective measure of this production, they ought to be more closely correlated.

CORRELATION BETWEEN SEVEN-DAY AND SEMI-OFFICIAL FAT PRODUCTION

In a similar way the coefficient of correlation between seven-day and semiofficial fat production has been determined. Table 11 gives the distribution from which this correlation has been calculated. From this table we find that the coefficient of correlation of fat production between the seven-day and the semiofficial tests is .703 $\pm$ .01, practically the same as that found for milk production; but, as in the case of milk production, altho it is a high correlation for certain purposes, it is not so regarded in this instance since the two tests are supposed to measure the same thing.

TABLE 11.—CORRELATION BETWEEN SEMIOFFICIAL AND SEVEN-DAY FAT PRODUCTION

Semiofficial Fat Production

Class interval; fat production, lbs.	251–225	326–400	401–475	476–550	551–625	626–700	701–775	776–850	851–925	926–1000	1001–1075	1076–1150	Total
7.01— 9.00	16	9	6	..	..	..	..	..	..	..	..	..	31
9.01—11.00	14	61	33	6	1	..	..	..	..	..	..	..	115
11.01—13.00	5	63	71	41	9	..	1	..	..	..	..	..	190
13.01—15.00	3	42	78	80	29	6	..	..	..	..	..	..	238
15.01—17.00	..	15	64	78	57	24	10	1	..	..	..	..	249
17.01—19.00	..	8	37	·51	55	45	12	3	1	..	..	..	212
19.01—21.00	..	1	9	24	36	32	16	2	1	1	..	..	122
21.01—23.00	..	1	5	14	17	16	11	5	4	..	..	..	73
23.01—25.00	..	..	2	6	6	8	5	7	4	5	1	..	44
25.01—27.00	..	..	..	1	1	2	1	4	3	2	..	..	14
27.01—29.00	..	..	..	..	1	..	1	..	..	1	..	..	3
29.01—31.00	..	..	..	..	..	..	..	1	1	..	1	1	4
Total.....	38	200	305	301	212	133	57	23	14	9	2	1	1 285

From this study of correlation it would seem that it makes little difference whether one considers milk production or fat production, since the coefficients of correlation in both cases are almost the same. It further follows that since the correlation between seven-day and semiofficial tests is not high, it is not safe to attempt to use the seven-day as a criterion by which to judge semiofficial production.

CONCLUSIONS

From the data presented the following conclusions seem war-ranted. Of course, since they are based on the average of a large number of records, it must be remembered that they do not necessarily apply to individual cases.

1. The semiofficial test represents fairly accurately the producing ability of cows.

2. There is a greater difference in fat percentage between low and high fat production shown by the seven-day test than by the semiofficial test.

3. There is a greater tendency for high fat percentage to accompany high fat production in the seven-day test than in the semiofficial test.

4. The variability in fat percentage is greater for the seven-day test than for the semiofficial test. In fact the difference between these two tests is quite significant.

5. The seven-day test shows a higher percentage of fat than the thirty-day test. The difference is most marked in high production.

6. The limited number of records available for comparison indicate that the seven-day test eight months after calving carries a higher fat percentage in low fat production and a lower fat percentage in high fat production than the seven-day test.

7. The correlation between seven-day and semiofficial tests is not high either in milk or in fat production, when it is considered that they are measurements of the same thing.

8. The data presented in this study indicate that the seven-day test is not a satisfactory criterion by which to judge semiofficial production.